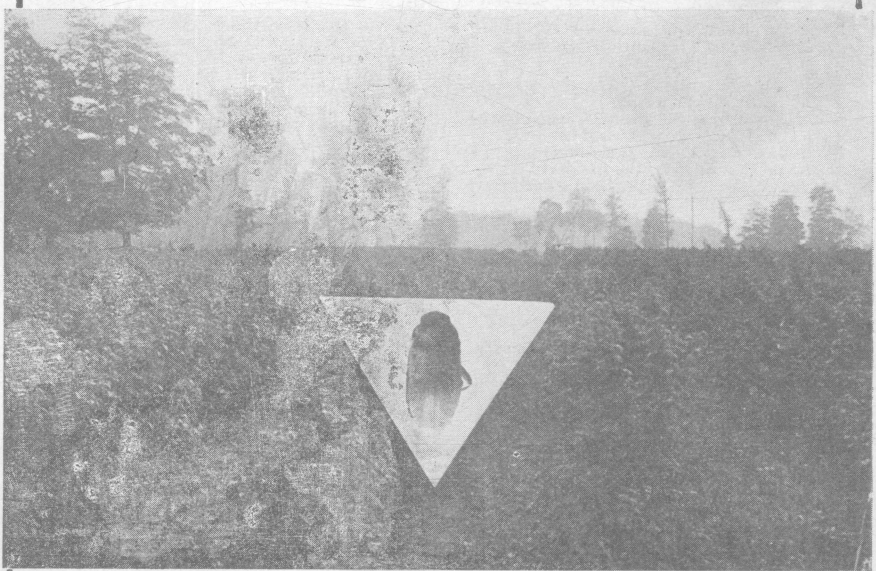
THE RASPBERRY BYTURUS

Byturus unicolor

OHIO
Agricultural Experiment Station

WOOSTER, OHIO, U. S. A., FEBRUARY, 1909.

BULLETIN 202



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BULLETIN

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NUMBER 202 FEBRUARY, 1909

THE RASPBERRY BYTURUS.

Byturus unicolor.

COLEOPTERA DERMESTIDAE

BY W. H. GOODWIN.

During the last two years quite a number of Ohio berry growers who raise red raspberries, have experienced considerable disappointment, suffering almost the total loss of their crop The yield of berries was not only below the normal bu the berries were not fit to put on the market. This necessitated selling them as seconds at a comparatively low figure. A few growers had also noticed that many of the flower buds did not bloom, or were imperfect when they did bloom.

THE CAUSE OF THE INJURY.

The cause of the injury is a small brown beetle, belonging to the same family as the buffalo carpet moth and the museum pests. This one, however, has the unusual habit of confining its attack to living plant tissues, instead of feeding on animal fibre and tissues as its near relatives do. This small brown beetle, the Raspberry Byturus, feeds upon the young leaves and buds of the raspberry, and the larvae develop in the head upon which the berry is borne, causing the affected berries to ripen earlier, and this tends to make them small and unfit for market.

Its injuries are severe, but these are usually confined to small and somewhat local areas. It probably has some insect enemies which hold it in check, in most cases, as it seems to disappear after a few years of abundance, during which it inflicts severe injury on red raspberries.

DISTRIBUTION.

The Byturus has been previously reported as injurious in Canada, Minnesota, Michigan, New York, Massachusetts and Ohio, showing that it is pretty well distributed over the eastern half of northern United States and Canada.

William Saunders reported this beetle as very destructive to the flowers of the raspberry in 1873, but does not give the exact locality in which he found it. Probably it was near Ottawa, Canada. Gillette in 1885 reports what is presumably this species doing considerable damage in the vicinity of Lansing, Michigan. The beetles are again reported by Fletcher as injurious to raspberries, in Canada, in 1887. Wm. Lochhead reports it in Canada in 1900-01, and Washburn in his ninth annual report for 1904, reports it as doing some injury to raspberry in Minnesota. Dr. Felt gives a review of the life history so far as it was known, in his report in the New York Museum bulletin, No. 23, of 1898, and suggests the possible similarity in its life history to *B. tomentosus*, a closely allied European species.

The first specimen of the beetle was brought from Arkansas by Nuttal. Say described it in 1823 as follows:

DESCRIPTION.

"*B. unicolor.* Reddish yellow, hairy thorax, each side depressed, tergum dusky, inhabits Arkansas, eyes black, thorax posterior angles broadly depressed and slightly reflected, the depression continued on the side but narrowed toward the anterior angles, wings dusky, length three-twentieths of an inch. This species is most closely allied to *B. tomentosus* of the authors. A single specimen brought from Arkansas by Mr. Nuttal."

LeConte and Horn give the following description in their *Coleoptera of North America:*

"The beetles are about one-seventh of an inch long, subcylindrical and of pale, reddish-brown color. With a lens, the dense, rather long, pale tawny hairs covering the entire upper surface are easily distinguished. The vesture of the under surface is shorter."

CONTRIBUTIONS TO ITS LIFE HISTORY.

Packard mentions the beetle in his report on the injurious insects of 1870, and records the date of its injuries as being in June. Fitch gives the following information in regard to the species, in his report for the same year (published in 1872):

"Adhering to the gathered fruit of the red raspberry, a very small, soft, tarnished, white worm, passing its pupal state under rubbish on the ground, and coming forth the latter part of May, an oval, pale yellow beetle, .15 inch long, densely clothed with short, fine gray hairs.

"Throughout our country there occurs on the fruit of the red raspberry a small, white worm, which commonly remains adhering to the berry when it is gathered, lying usually on the inner side of the cup or cavity in the berry. Hereby the fruit is rendered unfit for the table or for preserving, until it has been looked over with the utmost care, and the berries closely examined one by one, each berry on which one of these worms is found being either thrown away or the worm removed from it. This picking over the berries to cleanse them from these worms is a most irksome task, in which many hours of valuable time are spent every year in most of the households in our country. And, notwithstanding this scrutiny, some of the worms no doubt remain, and are unconsciously eaten with the berries, it being impossible for the most piercing sight to detect them in every instance, especially those that are young and minute.

"When examined with a magnifying glass, these worms are plump and cylindrical, slightly tapered at each end, and nearly one-fourth of an inch in length when full grown. They are white, each segment having on the back a broad, pale, tawny yellow band, occupying more than half its surface, and being also furnished with a few short, erect, whitish hairs. The mouth is darker tawny yellow. On the breast are three pairs of legs, but none on the body, back of these, except at the tip, which is prolonged into a single proleg of a short, conic form, and blunt at its end; and on the apex of the last segment, above the base of the proleg, are two minute projecting points, appearing like two deep red dots.

"When the worm is fully grown, it drops to the ground, probably with the fall of the berry in most instances, and secreting itself under any dead leaves or other rubbish which it there finds, it forms a cell in the dirt, in which it changes to a hairy pupa of a pale, dull yellowish color, and in this situation remains at rest through the winter, and till the middle of May or a little later, when it changes to its perfect form, and is then a small beetle about twice as long as thick, varying in its length from .12 to .15 of an inch.

"This beetle is of an oval form, its opposite sides almost straight and parallel, quite convex above and flat on the under side. It is throughout of a pale, dull yellowish color, sometimes tinged with chestnut brown, or reddish, and is covered above and beneath with exceedingly fine, short grayish hairs, which are appressed to the

surface and arise from fine close punctures, on the wing covers these hairs being finer and less visible. The head is small, roundish, flattened upon the face, and held vertically, sunk into the thorax to the eyes, which are rather large, black, round, and very convex and protuberant. The upper lip is transverse, its edge with a slight, broad, shallow notch or concavity. The antennae are short, not reaching the base of the thorax when turned backward. They are thread-like, with their tips enlarged into a little knob the shape of an egg reversed. They are composed of eleven joints, which though distinct are compactly united. The basal joint is largest and gradually widens toward its apex. The two next joints are short; and thicker than those which follow, which gradually but very slightly decrease in thickness to the three last, which are enlarged into the knob, and are more broad than long, the last joint being hemispheric and with the convex side outward. The thorax is more wide than long, scarcely wider across its base than its apex, convex above, and on each side abruptly depressed into a thin outer edge, which is much widened at the base, the basal angles being rectangular. The scutel is small, square, and rounded on its hind side. The wing covers are scarcely broader than the thorax, and have slightly elevated slender lines running lengthwise. The legs are of medium size, the hind pair longest, the thighs thick and stout and slightly narrowed at each end, the shanks gradually thicker toward their tips. The feet are more slender, their soles with dense, fine hairs. They are five-jointed, the middle joints very small, the fourth joint minute and concealed between the lobes of the third joint; the last joint longest, equaling all the preceding joints in length, with a pair of small hooks at its end which are strongly curved and furnished with a prominent tooth at their base."

HABITS.

The beetles appear in northern Ohio several weeks earlier than they have been reported as occurring in other states, having appeared as early as May 10th, in 1908. The beetles are pale yellowish-brown in color when they first emerge, but get much darker in a few hours. They often fly to the tender leaves and buds of the raspberry bushes before they have assumed their normal color, and immediately commence feeding on the tender leaves, and on the under sides of lone buds, and on the inner contiguous sides of clustered buds. In the latter case, where the buds are touching each other, they do the most damage, as they often eat out the sexual organs of all the adjacent buds in a cluster. Most of the tender leaves are partly skeletonized, and sometimes completely so, when the beetles are plentiful.

EGGS AND LARVAE.

On June 1st, I could not find any eggs but did find a few beetles mating. The berries were in bloom, or just setting, with a few buds on many clusters that would not bloom for several days. Three weeks later no beetles could be found, but young larvae, scarcely visible without a lens, could be found just eating through the fleshy base (receptacle) upon which the berry is borne.

LOCATION OF THE LARVAE.

In almost every case the larvae were found in the fleshy head and not in the composite fruits of the berry. Very few larvae were found clinging to the inside of the berries when they were removed from the stem. This habit of eating holes through the head on which the berry is borne, usually resulted in leaving the worms in that part, when the berry was picked. Out of a large number of larvae taken at this time, the living ones were placed in a breeding jar containing moist soil and leaves.

PUPATION HABITS.

A few of the larvae formed pupal cells in the soil of the breeding jar. These subsequently died through being disturbed and because of the lack of moisture; my inattention being due to the interference of other important field work at a distance from headquarters. My observations, however, substantiate the statement of Dr. Fitch that they pupate in the soil.

VARIETIES INJURED.

In the variety plots at the Station a few infested berries were found in the Kings in early July, but none of the other varieties of red raspberries seemed to be affected. A visit to the plots at Olmstead, Ohio, shortly after the berry crop had been picked, brought out the fact that almost all of the late, scattering berries were infested with larvae. Since the bloom for these late berries opened from 15th to the 20th of June, this seems to prove that the beetles were present as late as the latter date, or else laid their eggs on the under side of the buds before the blossoms expanded and the eggs hatched several days later.

PREVIOUS REMEDIAL WORK.

Hand picking has been recommended, otherwise no remedial work, so far as the author knows, has been done to prevent the injuries of this insect; but it is self-evident that if a poison were sprayed on the leaves and buds it would be the means of destroying most of the beetles, providing they eat the poisoned leaves. Dr. Fitch recommends the use of arsenicals as a means of controlling the insect, but does not metion whether these poisons had been

tried in an experimental way. The beetles were reported by Mr. S. O. Upp of Olmstead, Ohio, as being very plentiful on May 10, 1908, thousands of them having seemingly appeared in his berry patch within a few hours, and work to prevent the destruction of the berry crop was started on May 12th.

REMEDIAL WORK AND VARIETIES SUBJECT TO ATTACK.

Part of the patch where the beetles were the thickest was sprayed with 15 percent kerosene emulsion, and the following day, the 13th, the entire block of red raspberries was sprayed by hand with *arsenate of lead, four pounds to each 50 gallons of water.* One thing noticable at this time was the large number of bud clusters of the King variety that were already severely injured, while the Cuthberts, another variety of red raspberries, were scarcely attacked. The longer and more open bud clusters of the Cuthberts, affording less opportunity for the beetle to feed conveniently, seemed to be the only reasonable explanation for this comparative immunity, because the tender leaves of the latter seemed to be injured fully as much as those of the Kings. The black raspberries were not attacked, and at no time during the season could I find any of the beetles in the blocks of black raspberries.

AMOUNT OF INJURY AND THE RESULTS OF SPRAYING.

In the sprayed plots of the Kings, as many as two undeveloped buds could be found on clusters of 10 to 12 berries, while a great many small clusters had no injured buds at all. In the unsprayed plot, almost every cluster of berries had from one to five buds so injured that they did not develop. These results may be fairly ascribed to spraying, since the injuries to the berries later in the season can only be controlled by lessening the number of adult beetles at the time they are feeding and so prevent the deposit of the eggs. Counts of the injured flower buds on the 20th of June showed the injury to the buds on unsprayed plots to be about thirty-five percent of the buds formed, while in the sprayed plots only eight to nine percent of the buds were destroyed. The berries were just beginning to ripen, and almost every early ripening berry had a larva of the *Bytu·us* in the fleshy part of the berry head. These larvae were almost full grown, and some had already left the berry head, although the berry had not fallen.

These results show the efficiency of an arsenate of lead spray, applied a few days before the beetles emerge from their pupal cells, which varies in different seasons, but is usually about the 10th of May in Northern Ohio. The spray may be applied more readily with a machine of the grape-sprayer type, but with one or two nozzles

so attached that the spray is thrown directly from above onto the berry bushes. In this way the bushes will be entirely covered with spray and a great deal of labor saved, besides enabling the grower to cover a larger area of berries in a comparatively short time.

YIELD OF BERRIES.

The yield of the berry patch, notwithstanding the extreme dry weather at the time the berries were ripening, was more than double that of the previous season. The yield for 1907, with the plots unsprayed, was 22 bushels. The yield for 1908, with the same plots sprayed, and notwithstanding the drought was 50 bushels, which is two and one-quarter times as many berries, with probably a great many more beetles present, than in the previous season.

RECOMMENDATIONS.

Spray heavily with arsenate of lead just before the emergence of the beetles and this will destroy most of the beetles and materially lessen their injury to the flower buds. In connection with this, thorough cultivation late in the fall, close up around the bushes, will destroy many of the pupae, or expose them to the freezes and thaws of winter, thereby causing their destruction. Spraying with kerosene emulsion is only to be recommended where the beetles are already very numerous, and the spraying with arsenate of lead has been deferred until after the beetles have appeared in large numbers; even then, the arsenate of lead will be fully as effective and last for a much longer period, but in extreme cases the two may be used together. Bordeaux may be added for fungous diseases, and will help to hold the arsenate of lead on the foliage and buds, making the spray slightly more efficient than if arsenate of lead were used alone.

ACKNOWLEDGEMENTS.

The writer wishes to acknowledge his obligations to Mr. S. O. Upp, of North Olmstead, Ohio, for his assistance in the spraying work; to Mr. Herbert T. Osborn, for securing the notes by Mr. Lochhead, and to Mr. H. A. Gossard, Entomologist of the Station, at whose direction the investigation was undertaken, for his suggestions.

EXPLANATION OF PLATE I.

Fig. 1 Early ripening berries infested with Byturus larvae.

Original.

Fig. 2 Receptacle eaten through by the Byturus larvae.

Original.

Fig. 3 Byturus larvae.

Original.

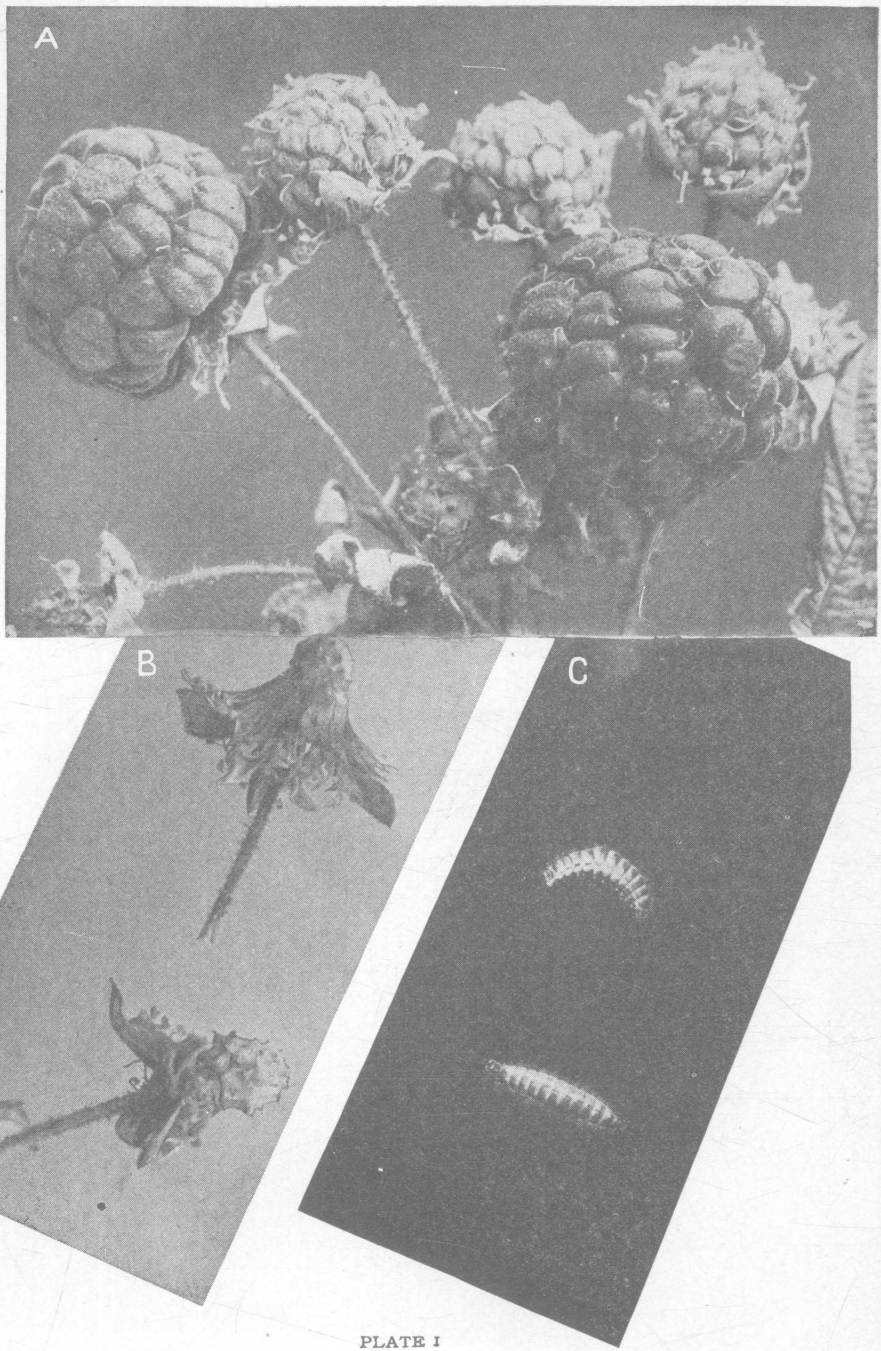

PLATE I

EXPLANATION OF PLATE II.

Fig. 1 Leaves skeletonized by the Byturus beetles. *Original.*

Fig. 2 Beetles much enlarged. *Original.*

Fig. 3 Injury to young leaves by the beetles. *Original.*

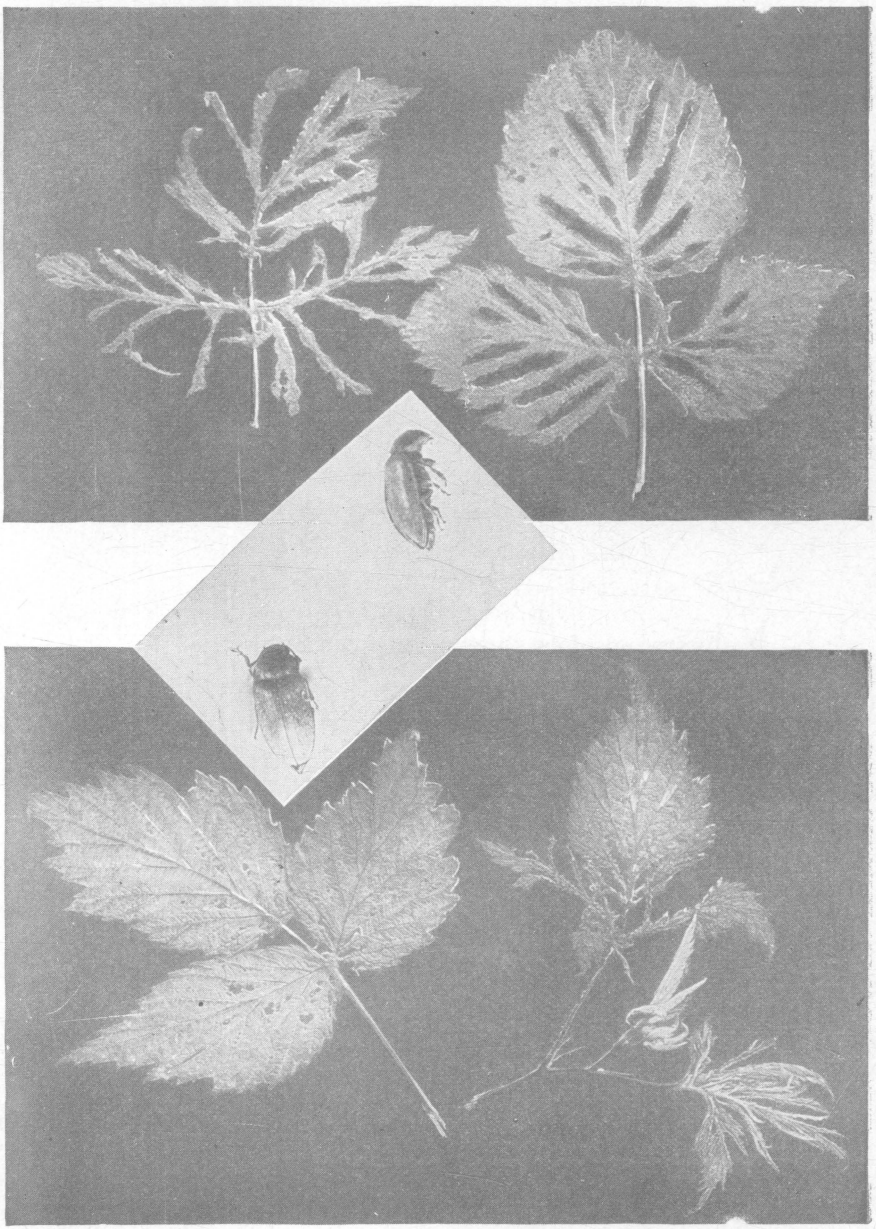

PLATE II.

EXPLANATION OF PLATE III.

Fig. 1 Appearance of berry clusters from unsprayed and sprayed plots showing injured buds. *Original.*

Fig. 2 Buds showing injury by beetles. *Original.*

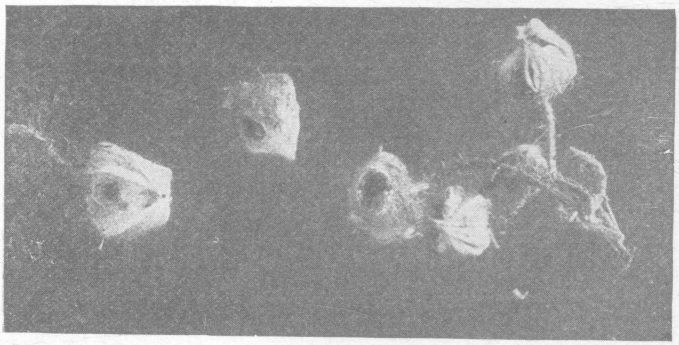

PLATE III.

BIBLIOGRAPHY.

Say, Thomas. Academy of Natural Sciences of Philadelphia. Journal, 1823, vol. 3: 197. Original description; the same in his complete writings, 1883, vol. 2: 126.

Packard, A. S. Guide to the Study of Insects. 1869, p. 448; Injurious Insects New and Little Known, Mar. 1870, p. 12, 13; pl. 1; fig. 12. Separate 1870, p. 31; pl. 1; fig. 1; 17th Report Sec. Mass. Board of Agr., 1870: p. 235-263, fig. 1-11; (New or Little Known Insects).

Fitch, Asa. N. Y. State Agr. Society. Transactions, 1870, 1872, vol. 30; 358-360. (Insects Injurious to the Raspberry.)

Saunders, William. Entomological Society of Ontario. Report 1873-1874, pp. 10-11. Insects Injurious to Fruits, 1883, 1889, 1904, pp. 310 and 311; fig. American Nat., Jan. 1871, vol. 4, pp. 684-688, pl. 6, figs. 154-156.

Jayne, H. F. American Philosophical Society, Proceedings, 1883, vol. 20; 345, 346, pl, 1, fig. 1-4.

LeConte, J. L. and Horn, C. H. Classification of the Coleoptera of North America, 1883, p. 141-143.

Gillette, C. P. Rural New Yorker, 1885, 44; 561.

Fletcher, James. Central Experimental Farm (Canada). Report of Entomologist and Botanist (Report of Minister of Agric.) 1887. Separate, p. 31, fig. 21.

Smith, J. B. Catalogue of the Insects of New Jersey, 1890, p. 143. Economic Entomology, 1896, 1906, p. 180, fig. 159.

Lintner, J. A. Insects of New York, 8th Report, 1893, p. 298.

Webster, F. M. Ohio Agr. Exp. Sta., B. 45, 1892, pp. 189-190. Insect Life, 1894, vol. 7, p. 204. Observations on Several Species of *Dermestidae*, 31st An. Rpt. Ent. Soc., Ontario, Feb. 1901, pp. 85-86.

Comstock, J. H. and A. B. Manual for the Study of Insects, 1895, 1907, p 541, fig. 649.

Chittenden, F. H. U. S. Dept. of Agr., Div. of Ent., Bulletin 8 (new series) 1897, p. 14.

Lochhead, W. Injurious Insects of the Orchard, Garden and Farm for the Season of 1899. 30th An. Rpt. of the Ent. Soc. of Ontario, 1899 (1900) pp. 66-71.

Lochhead, W. Injurious Insects of the Season of 1901. 32nd An. Rpt. of the Ent. Soc. of Ontario, 1901 (1902) p. 43-50, 13 figs.

Lochhead, W. Some Raspberry Pests. Canadian Horticulturist, July 1901, p. 278-279, 9 figs.

Washburn, F. L. 9th An. Rpt. State Entomologist, Minn., f. year 1904, St. Anthony Park, Minn. Dec. 1904, p. 52, fig. 34.

Felt, E. P. Bulletin N. Y. State Mus. of Nat. Hist. vol. 5, No. 23, Dec. 1898, pp. 158-160.

Lugger, Otto. Bulletin No. 66, University of Minnesota, Dec. 1899.